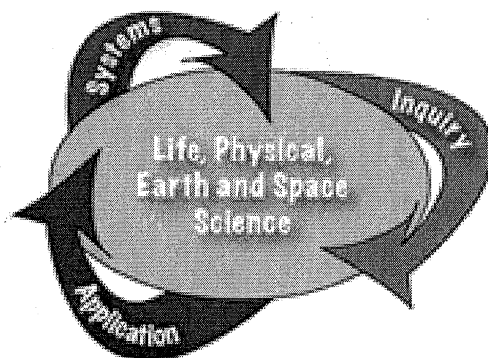


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Biology A/B

End of Course Assessment PRACTICE Scenarios



The Biology EOC exam will be administered in June

Table 1. Relative weighting of Systems, Inquiry, Application (EALRs 1-3) and Life Science domain (EALR 4)

EALR	MC/CP	SA	Percent of Exam
1: Systems (<i>crossed with Life Science and alone</i>)	5-8	0-1	At least 15
2: Inquiry (<i>crossed with Life Science and alone</i>)	6-10	1-3	20 – 25
3: Application (<i>crossed with Life Science and alone</i>)	5-8	1-3	12-17
4: Life science domain of EALR 4 (<i>alone</i>)	18-24	0-1	45 – 50
Total number of items on exam	35	5	
Total number of points on exam	35	10	

North Mason High School Science Department 2012/2013
Ramey LeRoy, Matt Lonsdale, Anna Munkres



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3 Cell Structure and Function	Animal Cell System	13		
5 Cell Energy	Blueberry Blues	18		
BIOLOGY B				
6 DNA and Proteins	How Did that Plant Get Here?	22		
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Appendix A – EOC Scoring Rubrics				
Appendix B – Science Vocabulary				

Notes

Ecology

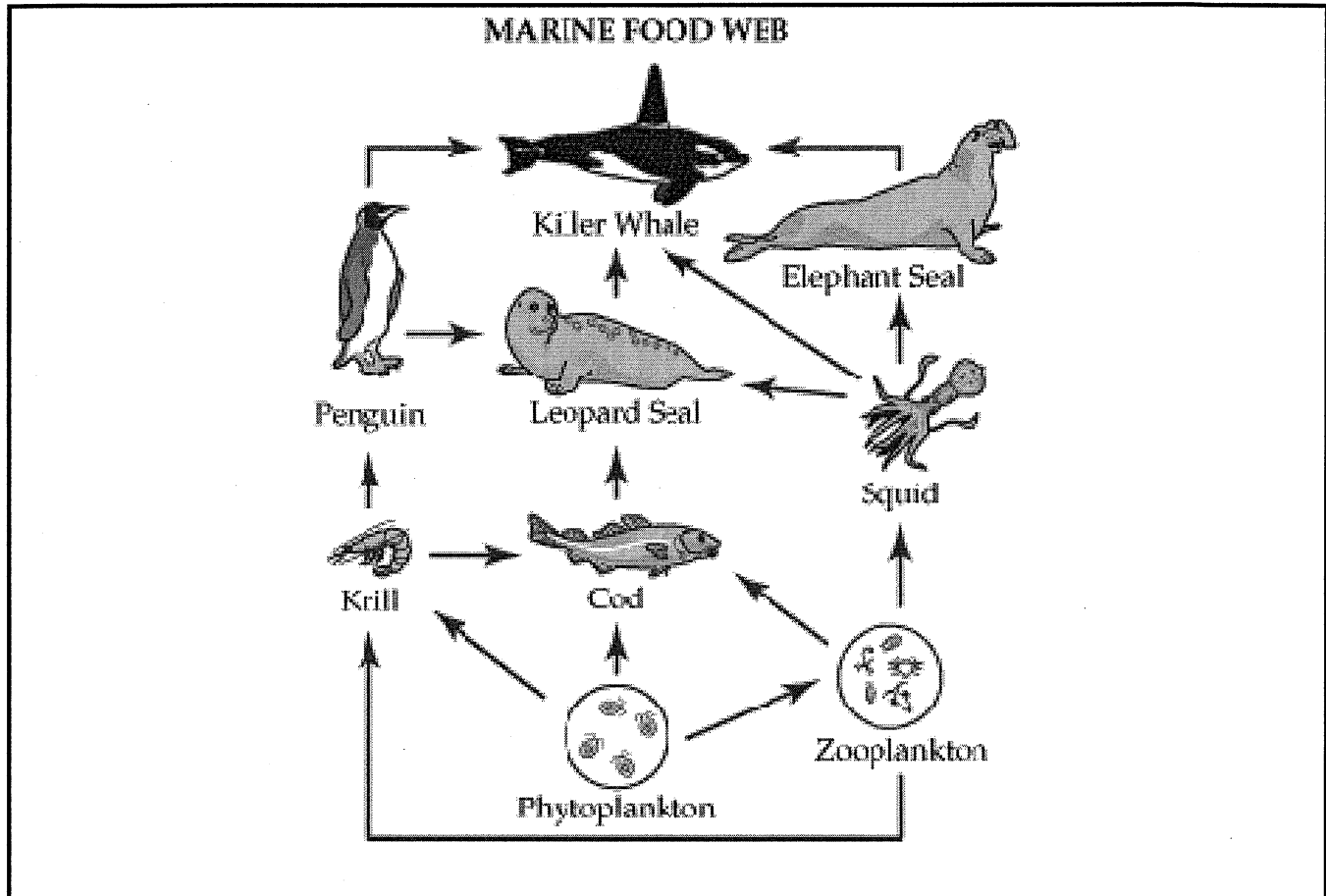
Biology EOC Scenario

Marine Food Web System

Directions: Use the following information to answer question 1

Mark and Jamie analyzed a marine food web system and made the following diagram.

Marine Food Web System



1 If overfishing removed the cod from this food web system, predict what would happen to the system?

- A. there would be no change in the system
- B. only the Leopard Seal would be affected in the system
- C. both the Leopard Seal and the Killer Whale would be affected in the system
- D. all organism would be affected in the system

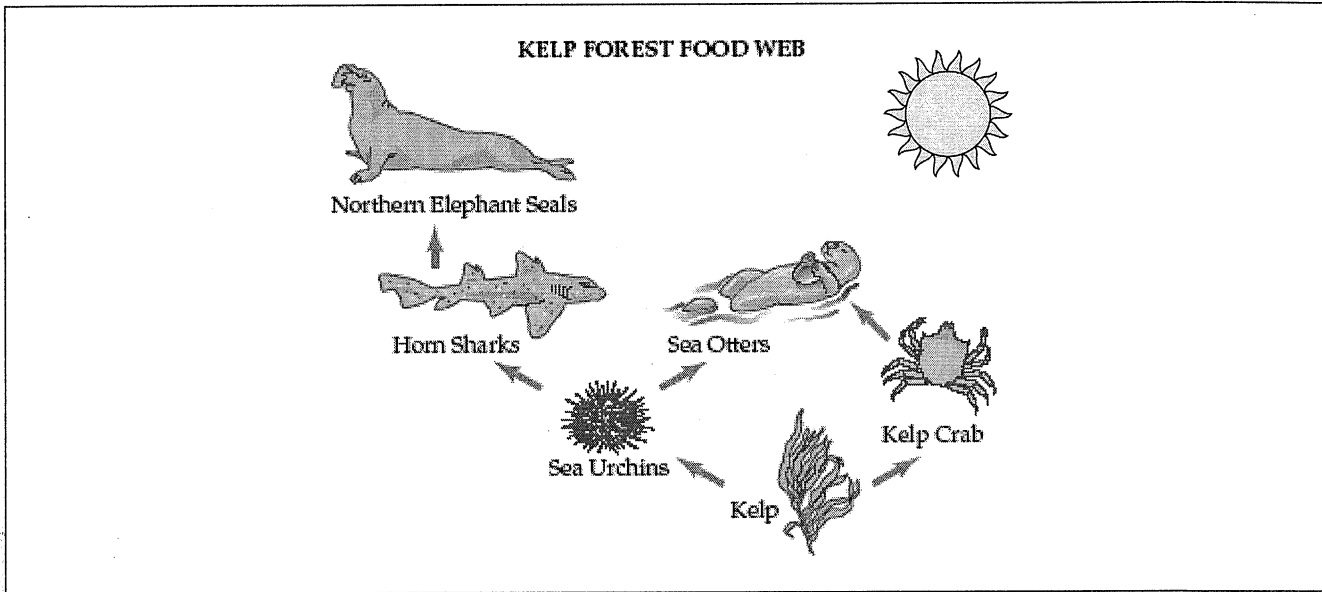
- 2 Which example below demonstrates negative feedback?
- A. after a cut, a clotting process cascades to form a scab
 - B. sunlight increases the production of Vitamin D in the skin
 - C. global warming contributes to the ice caps melting
 - D. increases cellular respiration results in cooling due to sweating
- 3 Photosynthesis inputs include...
- A. carbon dioxide/water
 - B. oxygen/water
 - C. carbon dioxide/glucose
 - D. glucose/oxygen
- 4 In an open population limiting factors include all the following except...
- A. water
 - B. shelter
 - C. food
 - D. air
- 5 In a 100 cubic meter volume of water there are 15,698 phytoplanktons. What is the population density per meter cubed?
- A. 156.98
 - B. 15.698
 - C. 1569.8
 - D. 1.5698
- 6 An example of negative feedback would include...
- A. greenhouse gasses contributing to global climate change
 - B. killer whale population increases and eats more penguins
 - C. a recycling program increases the use of natural resources
 - D. body temperature increases due to exercise

7 Describe **two** energy transfers that happened in this marine food web.

In your description, be sure to:

- Identify the **form** of energy before and after each transfer.
- Describe **where** the energy transfers happen.

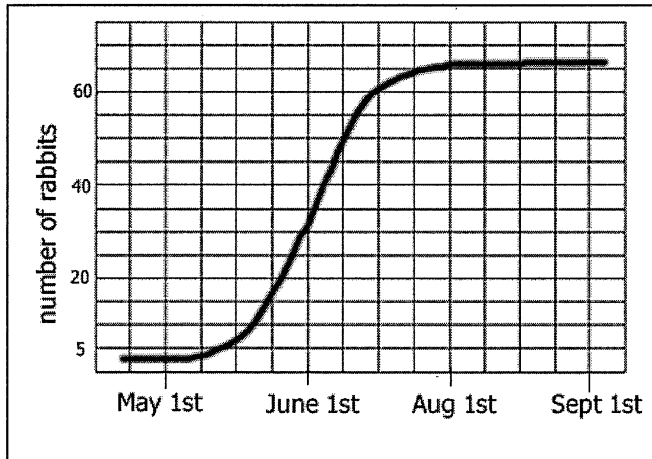
You may use words, labeled pictures, and/or labeled diagrams on the diagram below.



Energy Transfer One:

Energy Transfer Two:

Use the population graph to answer questions 8-11.



- 8 During what month were the rabbits reproducing rapidly.
- A. May
 - B. June
 - C. August
 - D. September
- 9 During what time frame did the rabbits' population level off?
- A. May-June
 - B. June-August
 - C. August-September
 - D. May-September
- 10 Approximately what number of rabbits can this ecosystem support?
- A. 5
 - B. 20
 - C. 40
 - D. 60
- 11 Describe factors that could limit the growth of the rabbit population.

12 What condition must be necessary in order for a population to increase rapidly?

- A. disease
- B. predators
- C. space
- D. competing organisms

13 Describe the interrelationship between plants and animals in a closed system.

In your description, be sure to:

- Identify or describe the cycling of carbon.

You may use words, labeled pictures, and/or labeled diagrams in your answer.

14 Which of the following processes does not release carbon dioxide into the atmosphere?

- A. combustion
- B. photosynthesis
- C. decomposition
- D. respiration

15 Which of the following processes is an example of matter cycling that negatively affects the health of an ecosystem?

- A. burning fossil fuels
- B. worm bins
- C. composting
- D. crop rotation

16 What organisms fix nitrogen into a useable form?

17 Why is the biodiversity of marine ecosystems higher than that of terrestrial ecosystems?

- A. marine ecosystems have more species
- B. marine ecosystem have been around longer
- C. marine ecosystems receive more sunlight
- D. marine ecosystems have less species

18 Which of the following is an example of sustainability?

- A. recycling
- B. burning fossil fuels
- C. removing trees
- D. unlimited population growth

19 Refer to the graph on page 4, what type of growth does it represent?

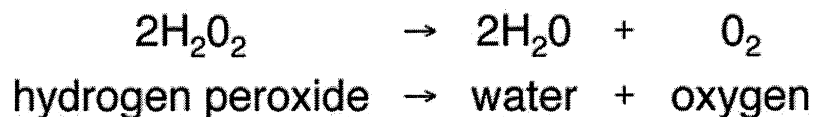
20 A L.E.E.D. certified platinum building uses all sustainable resources, describe how that development helps with current resource issues.

Chemistry of Life

Biology EOC Scenario

Foaming Spuds

Mike and Kelsey were studying how hydrogen peroxide (H_2O_2) in cells breaks down to form water and oxygen. When this reaction happens, bubbles of oxygen gas are released, producing foam. This reaction is described as follows:



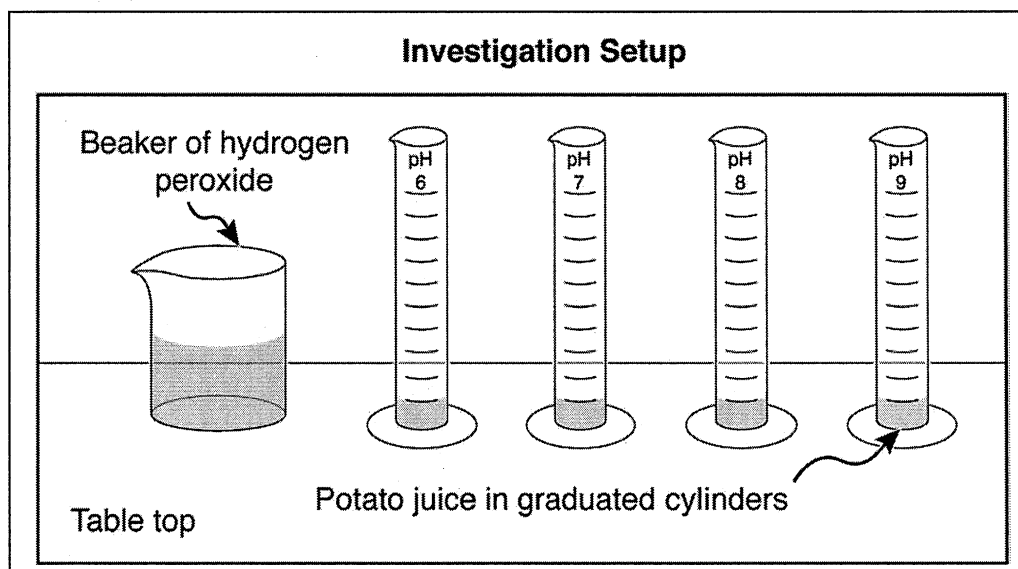
A protein named *catalase*, found in all cells including potatoes, increases the rate of this reaction. Mike and Kelsey used potato juice as the source of *catalase* to do the following controlled experiment.

Question: What is the effect of the acidity of potato juice on the volume of foam produced when hydrogen peroxide is added to potato juice?

Prediction: As the acidity of potato juice decreases (higher pH), the volume of foam will increase.

Materials:

- graduated cylinders labeled pH 6, pH 7, pH 8, and pH 9
- potato juice from the same potato, divided and adjusted to four acidities: pH 6, pH 7, pH 8, and pH 9
- hydrogen peroxide (H_2O_2)
- beaker
- stopwatch
- stirring rods
- thermometer



Procedure:

1. Label four graduated cylinders, one for each acidity.
2. Put 10 milliliters of potato juice at pH 6 in the appropriately labeled cylinder.
3. Do the same for each of the other cylinders.
4. Monitor the room temperature to make sure the temperature remains the same throughout the investigation.
5. Add 5 milliliters of hydrogen peroxide to each graduated cylinder, stir for two seconds. Wait three minutes.
6. Measure and record the volume of foam in each graduated cylinder as Trial 1.
7. Clean all graduated cylinders and stirring rods.
8. Repeat steps 1 through 7 two times for Trials 2 and 3.
9. Calculate and record the average volume of foam for each acidity of potato juice.

Acidity of Potato Juice (pH)	Volume of Foam (milliliters)			
	Trial 1	Trial 2	Trial 3	Average
6	22	25	25	24
7	32	38	36	35
8	41	42	42	42
9	32	29	30	30

1. How could Mike and Kelsey be more certain the results of their experiment are **reliable**?

- A. test the reaction with other acidities of potato juice.
- B. repeat the experiment the same way.
- C. increase the volume of potato juice.
- D. use a different type of plant juice.

2. What did Mike and Kelsey do to make the results of their experiment **valid**?

- A. record the volume of foam in milliliters.
- B. calculated the average volume of foam for each acidity.
- C. measured the volume of foam at each acidity three times.
- D. wait three minutes before measuring the volume of foam.

3. What factor caused the protein catalase to produce less foam?

- A. change in the acidity
- B. change in the amount of catalase
- C. change in the amount of time
- D. change in the temperature

8

4. Mike and Kelsey would like to conduct another scientific investigation. Which question can be investigated scientifically?
- A. what is the chemical formula for catalase?
 - B. what is the effect of temperature on volume of foam?
 - C. where does hydrogen peroxide come from?
 - D. what type of potato does Kelsey like the best?
5. What is the responding variable in the scientific investigation?
- A. acidity
 - B. amount of catalase
 - C. volume of foam
 - D. amount of potato juice
6. What is the manipulated variable in the scientific investigation?
- A. acidity
 - B. amount of catalase
 - C. volume of foam
 - D. amount of potato juice
7. Mike and Kelsey conducted which type of scientific investigation?
- A. field study
 - B. observation
 - C. controlled experiment
 - D. scientific model
8. When new evidence is discovered by scientists, this can cause scientists to
- A. revise a theory
 - B. revise the hypothesis
 - C. change the data
 - D. choose different variables

9. Write a conclusion for this controlled experiment.

In your conclusion, be sure to:

- Answer the experimental question.
- Include **supporting** data from the Acidity of Potato Juice vs. Volume of Foam table.
- Explain how these data **support** your conclusion.
- Provide a **scientific** explanation for the trend in the data.

Question: What is the effect of the acidity of potato juice on the volume of foam produced when hydrogen peroxide is added to potato juice?

10. In the equation for the breakdown of hydrogen peroxide, the input(s) include the following:

- A. hydrogen peroxide
- B. hydrogen peroxide and water
- C. hydrogen peroxide and oxygen
- D. water and oxygen

11. In the equation for the breakdown of hydrogen peroxide, output(s) include the following:

- A. hydrogen peroxide
- B. hydrogen peroxide and water
- C. hydrogen peroxide and oxygen
- D. water and oxygen

12. The Law of Conservation of Matter is demonstrated in the breakdown of hydrogen peroxide by
- A. the rate at which the hydrogen peroxide breaks down
 - B. the inputs equaling the outputs
 - C. the volume of foam produced
 - D. the mass of the water and oxygen
13. Which of the following is a macromolecule?
- A. fatty acid
 - B. nucleic acid
 - C. amino acid
 - D. sulfuric acid
14. What class of macromolecules do enzymes belong to?
- A. proteins
 - B. nucleic acids
 - C. lipids
 - D. carbohydrates
15. Which of the following statements correctly describes polymers being broken down into monomers?
- A. nucleic acids to amino acids
 - B. proteins to amino acids
 - C. carbohydrate to amino acids
 - D. lipids to amino acids
16. Monomers such as amino acids and fatty acids come from what source?
- A. food
 - B. sun
 - C. DNA
 - D. water

17. Where does the chemical energy used to drive cell processes comes from?

- A. DNA
- B. ATP
- C. RNA
- D. mRNA

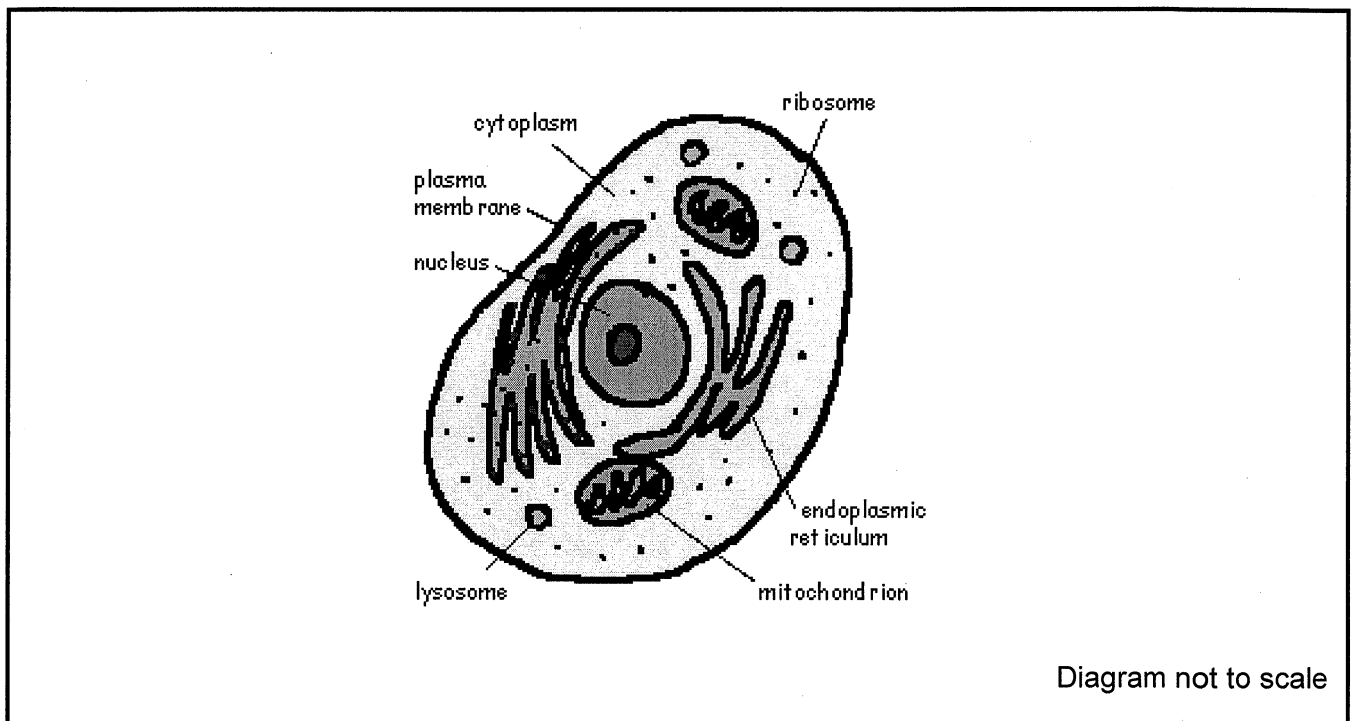
Cell Biology

Biology EOC Scenario

Animal Cell System

The cell system below is from an animal and shows various organelles present within the cell system.

Animal Cell System

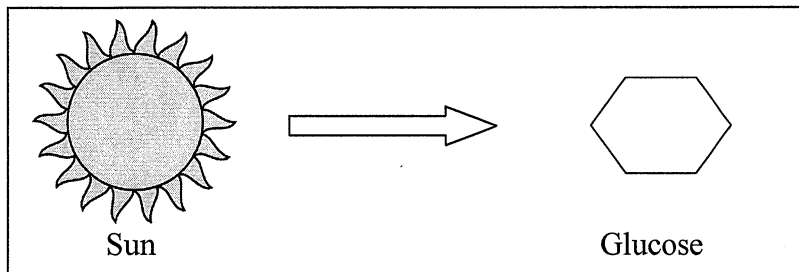


1. Which of the following is NOT an input into the animal cell system?
 - A. water
 - B. light
 - C. carbon dioxide
 - D. oxygen
2. What would occur to the animal cell if the lysosomes malfunctioned?
 - A. the cell would not be affected
 - B. old organelles would not be recycled and replaced
 - C. the animal cell would not be able to reproduce
 - D. proteins would not be synthesized

3. What is the function of the nucleus in the cell?

- A. transport waste
- B. build proteins
- C. control cell functions
- D. create energy

Use the diagram below to answer questions 4-



4. This diagram represents what cellular process?

5. Where in the cell would this cellular process occur?

6. What type of energy transfer represented?

- A. solar energy to chemical energy
- B. chemical energy to solar energy
- C. chemical energy to chemical energy
- D. solar energy to solar energy

7. Cellular respiration is similar to the burning of fossil fuels because

- A. both processes burn carbon and release energy
- B. both processes burn carbon and release oxygen
- C. both processes burn carbon and release glucose
- D. both processes burn carbon and release nitrogen

8. The function of the cell membrane is to
- A. maintain stability and support
 - B. synthesize new proteins
 - C. direct all of the cells activities
 - D. regulate the flow of materials into and out of the cell
9. Oxygen moving from the lungs to the bloodstream is an example of what type of transport?
- A. osmosis
 - B. diffusion
 - C. facilitated diffusion
 - D. active transport
10. The process that allows glucose to pass through a carrier protein in the cell membrane from a high concentration to a low concentration is called
- A. active transport
 - B. diffusion
 - C. facilitated diffusion
 - D. osmosis
11. Cellular respiration converts glucose into what form of usable energy that can be used by the body?
- A. oxygen
 - B. ATP
 - C. glucose
 - D. carbon dioxide
12. The structure of the cell membrane can be described as
- A. monolayer with no embedded proteins
 - B. bilayer with no embedded proteins
 - C. monolayer with embedded proteins
 - D. bilayer with embedded proteins

13. Cells contain specialized parts for determining essential functions such as regulation of cellular activities, energy capture and release, formation of proteins, and waste disposal. What would happen to an animal cell if the cell membrane could no longer regulate the movement of substances into and out of the cell?

In your description or explanation, be sure to:

- Identify and describe 3 other organelles that would be affected this.
- Explain how this would specifically affect cellular respiration as one of your examples.

You may use words, labeled pictures, and/or labeled diagrams in your answer.

14. Which of the following correctly represents an input followed by an output of cellular respiration?

- A. carbon dioxide, oxygen
- B. oxygen, carbon dioxide
- C. nitrogen, carbon dioxide
- D. oxygen, nitrogen

15. Food is broken down by proteins called
- A. enzymes
 - B. ribosomes
 - C. hemoglobins
 - D. steroids
16. What molecule does photosynthesis produce that is an input of cellular respiration?
- A. oxygen
 - B. water
 - C. glucose
 - D. carbon dioxide
17. Which types of transport requires energy in the form of ATP?
- A. passive
 - B. active
 - C. facilitated
 - D. osmosis
18. The inputs for photosynthesis are 6 molecules of carbon dioxide and 6 molecules of water for a total of 36 atoms. How many total atoms are in the outputs of sugar and oxygen?
- A. 6
 - B. 12
 - C. 24
 - D. 36
19. The role of photosynthesis in the life of plants can be best described as
- A. photosynthesis is the source of glucose for the plant
 - B. photosynthesis is the source of oxygen for the plant
 - C. photosynthesis is the source of carbon dioxide for the plant
 - D. photosynthesis is the source of water for the plant

Cell Energy

Biology EOC Scenario

Blueberry Blues

José and Tasha noticed last year the blueberry plants in their neighborhood garden had many flowers, but produced only three kilograms of berries. They wanted to change the garden so the blueberry plants would produce more blueberries this summer. While making the changes to the garden, José and Tasha documented the stages of their design process as follows.

Problem: Change the neighborhood garden so the existing blueberry plants will produce more blueberries.

Research the Problem: **Research what blueberry plants need to grow, be healthy, and produce berries.**

Needs of Blueberry Plants

Mineral nutrients	Nitrogen
Amount of light	At least 6 hours of full sunlight every day
Amount of water	Regular with moderate amount
Type of pollinating insects	Bees
Needs of the pollinators	Nectar, pollen, water, nesting place

Explore Ideas:

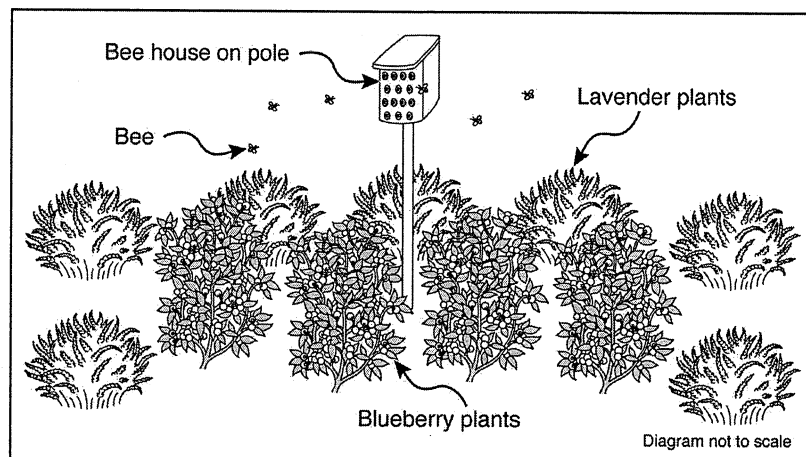
- Add a layer of bark to the garden so the soil can hold more water.
- Water the plants at night so the water will evaporate more slowly.
- Add fertilizer to increase the mineral nutrients in the soil.
- Add flowers like lavender, roses, or pansies.
- Put a bee house near the plants.

Plan Summary: Add a bee house and some lavender plants to the neighborhood garden to attract more bees to the blueberry plants.

Steps to Do the Plan:

1. Put a bee house in the middle of the blueberry plants.
2. Plant lavender plants around the edge of the blueberry plants.
3. Water the garden every day.
4. Remove the weeds in the garden every week

Diagram of Solution:



Test Solution: Measure and record the mass of all the blueberries harvested this year. Compare the mass of the blueberries this year to the mass of the blueberries last year.

Test Results: Ten kilograms of blueberries were harvested, which is seven kilograms more than last year.

1 Jose and Tasha want to improve the soil in the garden by increasing the population of worms in the soil. Describe how to begin solving this problem. Be sure to describe the following stages in your design process:

Problem: Increase the population of worms in the soil
Research the Problem: Describe any scientific information needed to solve the problem and how to collect that information.
Explore Ideas: Describe several possible solutions to the problem, including any useful scientific concepts.

- 2** What part of the cell produces ATP for the blueberry plant to grow?
- A. mitochondrion
 - B. cytoplasm
 - C. ribosome
 - D. nucleus

3 What is the role of cellular respiration in plants?

- A. to absorb carbon dioxide
- B. to release oxygen
- C. to produce ATP
- D. to form glucose

4 Blueberries contain sugars like glucose. What is the source of carbon for the glucose in blueberries?

- A. carbon atoms in fertilizer
- B. carbon dioxide gas in air
- C. carbon dissolved in water
- D. carbon molecules in the soil

5 What is the source of energy for the blueberries to grow?

- A. chemical
- B. solar
- C. nuclear
- D. thermal

6 What organelle is the site of photosynthesis in plants?

- A. chloroplast
- B. mitochondrion
- C. nucleus
- D. ribosome

7 What are the outputs of the photosynthesis reaction?

- A. carbon and oxygen
- B. water and oxygen
- C. glucose and carbon dioxide
- D. glucose and oxygen

8 How does carbon dioxide enter the leaf cells?

- A. osmosis
- B. protein pump
- C. facilitated diffusion
- D. diffusion

9 What would happen if a successful non-flowering competitor plant was introduced into the ecosystem with the blueberries and lavender?

- A. biodiversity would increase
- B. biodiversity would stay the same
- C. biodiversity would decrease
- D. more blueberries would be produced

10 Explain 2 constraints to the experimental set-up at the beginning of this scenario.

Test Results: Ten kilograms of blueberries were harvested, which is seven kilograms more than last year.

Constraint:
Another Constraint:

DNA

Biology EOC Scenario

How Did that Plant Get Here?

Demetri did the following investigation in a local college laboratory to see how carbon dioxide (CO_2) affects plant growth.

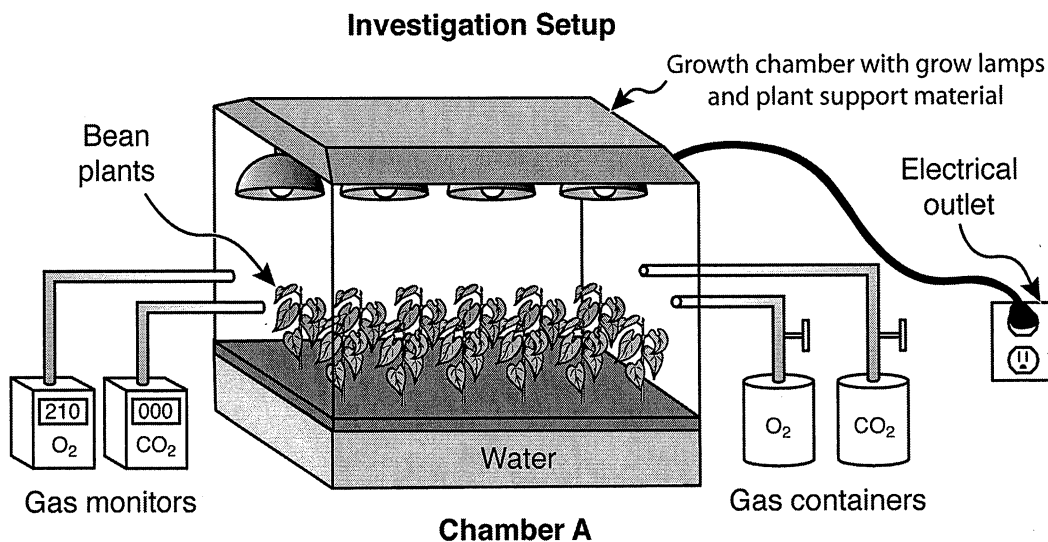
Demetri grew bean plants in growth chambers where he could control the amount of oxygen (O_2) and CO_2 in the air around the plants. He grew the bean plants in water with mineral nutrients instead of soil. Demetri had to completely dry the plants in an oven to get the plants' dry mass.

Question: What is the effect of different amounts of carbon dioxide (CO_2) in air on the dry mass of bean plants?

Hypothesis: As the concentration of CO_2 in air increases, the dry mass of bean plants will increase because bean plants use CO_2 for growth.

Materials:

- bean plants with the same mass
- water with mineral nutrients
- identical growth chambers labeled A, B, and C
- containers of CO_2 and O_2 gas
- monitors for CO_2 and O_2 gas
- oven
- balance



Procedure:

1. Put 12 bean plants into Chamber A as shown in the Investigation Setup diagram. Do the same to Chambers B and C.
2. Make sure each chamber receives the same amount of light and water. Keep the chambers at a constant temperature and pressure.
3. Adjust the O₂ level of the air in each chamber to the normal amount of O₂ in the atmosphere.
4. Remove 4 bean plants from each chamber. Dry the plants in the oven and measure their dry masses.
5. Calculate and record the average dry masses as Day 1.
6. Set and keep the CO₂ level in Chamber A at 0 parts per million (ppm), Chamber B at 700 ppm, and Chamber C at 1,400 ppm.
7. Repeat steps 4 and 5 for Day 7 and Day 14.

Data: Amount of CO₂ vs. Bean Plant Dry Mass

Amount of CO ₂ (parts per million)	Bean Plant Dry Mass (averages in grams)		
	Day 1	Day 7	Day 14
0 (Chamber A)	0.8	0.8	0.8
700 (Chamber B)	0.8	4.5	8.6
1,400 (Chamber C)	0.8	5.7	10.8

Note: Day 1 masses were determined before CO₂ levels were adjusted.

- 1 Which two variables were controlled variables in this investigation?
 - A. final bean plant dry mass and amount of light
 - B. amount of CO₂ and type of growth chamber
 - C. growth of plants and amount of O₂
 - D. type of plants and amount of O₂

- 2 Which variable was the manipulated variable in this investigation?
 - A. carbon dioxide concentration in each chamber
 - B. type of mineral nutrients added to the water
 - C. size of bean plants after 14 days
 - D. volume of oxygen gas containers

- 3 Which variable was the responding (dependent) variable in this investigation?
 - A. hours of light
 - B. bean plant dry mass
 - C. total days bean plants grew
 - D. mineral nutrients in the water

4 Write a conclusion for this investigation.

In your conclusion, be sure to:

- Answer the experimental question.
- Include **supporting** data from the Acidity of Potato Juice vs. Volume of Foam table.
- Explain how these data **support** your conclusion.
- Provide a **scientific** explanation for the trend in the data.

Question: What is the effect of different amounts of carbon dioxide (CO₂) in air on the dry mass of bean plants?

5 Why did Demetri have growth chamber A adjusted to 0 ppm of CO₂?

- A. To show bean plants can make their own CO₂ when none is available
- B. To make the bean plants use oxygen for photosynthesis instead of CO₂
- C. To ensure the amount of CO₂ caused the differences in dry mass
- D. To demonstrate that CO₂ is used by the bean plants for respiration

6 Demetri wants to increase the CO₂ level from 1,400 ppm to 2,800 ppm and measure the effect on the dry mass of the bean plants. Which of the following predictions is supported by the Amount of CO₂ vs. Bean Plant Dry Mass table?

- A. The dry mass would be constant because O₂ levels limit the rate of photosynthesis.
- B. The dry mass would rise slightly because the rate of photosynthesis limits growth.
- C. The dry mass would double because CO₂ levels determine the rate of photosynthesis.
- D. The dry mass would decrease because high CO₂ levels are harmful to plants.

7. Plan a new investigation to answer the new question printed in the box.

In your plan, be sure to include:

- Hypothesis
- Materials
- Procedure that includes:
 - logical steps to do the investigation
 - two controlled variables
 - one manipulated variable
 - one responding variable
 - an experimental control condition
 - how often measurements should be taken and recorded

Question: What is the effect of different amounts of mineral nutrients on the height of plants grown in CO ₂ rich atmosphere?
Hypothesis:
Materials:
Procedure: You may use this space for a labeled diagram to support your procedure.
Procedure (continued):

- 8** This process by which mRNA is used to code for a protein strand is called
- A. replication
 - B. translation
 - C. transcription
 - D. translocation

- 9** Predict the complimentary strand of mRNA given the DNA nucleotide sequence ATTAGCGGCTAC?
- A. ATTAGCGGCTAC
 - B. AUUAGCGGCUAC
 - C. UAAUCGCCGAUG
 - D. TAAATCGCCGATG

10 What type of mutation is represented by the following change in the DNA strand from ATTAGCGGCTAC to ATTAGCGCCTAC?

- A. insertion
- B. deletion
- C. frame shift
- D. substitution

11 Where does transcription of DNA occur?

- A. nucleus
- B. cytoplasm
- C. ribosome
- D. mitochondrion

12. In what organelle would you find DNA?

- A. nucleus
- B. endoplasmic Reticulum
- C. ribosome
- D. vacuole

13. Which macromolecule does DNA contain the instructions to build?

- A. lipids
- B. carbohydrates
- C. nucleic Acids
- D. proteins

14. Which base would you not find in an RNA molecule?

15. Which is the correct sequence for building proteins?

- A. DNA → mRNA → tRNA → Protein
- B. mRNA → tRNA → DNA → Protein
- C. Protein → mRNA → DNA → tRNA
- D. DNA → Proteins → tRNA → mRNA

16. Which structure inside a cell is responsible for building proteins?

- A. Mitochondria
- B. Nucleus
- C. Ribosome
- D. Lysosome

17. If there was a mutation in the DNA, which macromolecule would be affected?

- A. protein
- B. carbohydrate
- C. lipid
- D. polysaccharide

18. When using the genetic code during translation, how many RNA bases code for one amino acid?

- A. 1
- B. 2
- C. 3
- D. 4

19. What are the four nucleotides in the DNA molecule?

20. Which molecule carries an amino acid to be assembled into a protein?

- A. mRNA
- B. tRNA
- C. DNA
- D. vesicle

Cell Cycle

Biology EOC Scenario

Aquarium System

Eleana and Jason wondered if water temperature affects the breathing rate of goldfish. They did the following investigation by counting gill movements as a measure of the breathing rate of goldfish.

Question: What is the effect of water temperature on the breathing rate of goldfish?

Hypothesis: The higher the temperature of water, the greater the breathing rate of goldfish because goldfish need more water over their gills at higher temperatures.

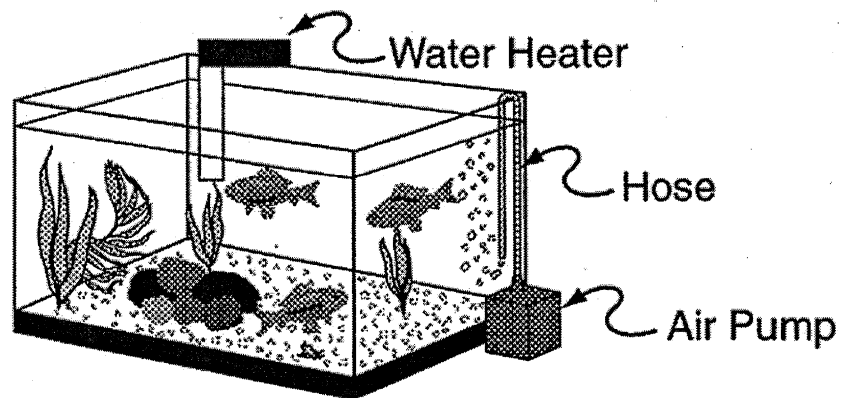
Materials:

thermometer

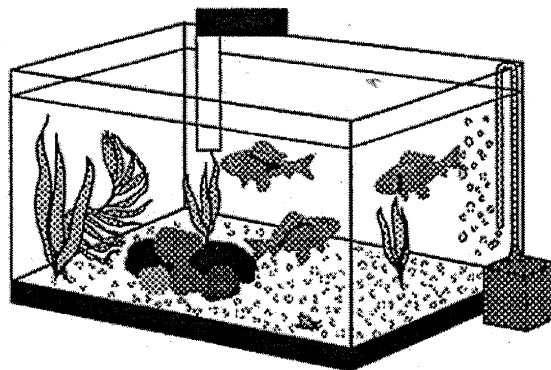
stopwatch

2 identical aquarium systems: glass aquarium with gravel and rocks on the bottom, water plants, water, goldfish, air pump, and heater

Aquarium System A



Aquarium System B



Procedure:

1. Establish which goldfish is #1, #2, and #3 based upon markings.
2. Count and record the number of times per minute the gills on each of the goldfish move in Aquarium Systems A and B at 20° C. Record initial breathing rates in the data table.
3. Allow Aquarium System B to cool to 10° C by turning off the water heater.
4. Count and record the number of times per minute the gills on each of the goldfish move in Aquarium Systems A and B. Record breathing rates in the data table.
5. Turn Aquarium System B's water heater back on. When the water is 15° C, repeat step 4.
6. When the water in Aquarium System B is 20° C, repeat step 4.
7. When the water in Aquarium System B is 25° C, repeat step 4.
8. When the water in Aquarium System B is 30° C, repeat step 4.
9. Allow the water in Aquarium System B to return to 20° C, repeat step 4.
10. Calculate and record the average breathing rate.

DATA: Water Temperature vs. Breathing Rate

Water Temperature		Breathing Rate (gill movements per minute)			
Aquarium System	Temperature (°C)	Fish 1	Fish 2	Fish 3	Average
A*	initial 20	70	63	65	66
B	initial 20	69	65	64	66
B	10	44	50	54	49
B	15	57	53	60	57
B	20	68	66	64	66
B	25	71	75	71	72
B	30	81	75	77	78
B	initial 20	67	69	63	66

All data for Aquarium System A are not included in this table. The three goldfish had varied breathing rates but the average remained 66 gill movements per minute throughout the investigation.

1 How does a fish breathe?

- A. the gills of the fish sweep the water into its lungs.
- B. the fish can absorb oxygen directly through its skin.
- C. the gills of the fish absorb oxygen dissolved in the water.
- D. there are tiny air bubbles in water that are absorbed by gills.

2 A small lake near Eleana and Jason's school has become covered with green algae. Dead fish are sometimes found on the shore of the lake. The city wants to solve the problem by installing a fountain that will spray the water straight up into the air. What would be the purpose of installing this fountain?

- A. to reverse the electrical charges in the water
- B. to increase the amount of water vapor in the air
- C. to increase the amount of dissolved gasses in the water
- D. to release hydrogen and oxygen atoms into the atmosphere

3 Which two variables were controlled (kept the same) in this investigation?

- A. water temperature and volume
- B. size of the goldfish and breathing rate
- C. breathing rate and size of the aquariums
- D. number of goldfish and size of the aquariums

4 What was the manipulated variable in this experiment?

- A. water temperature in the aquarium system
- B. type of fish
- C. amount of water in aquarium
- D. average breathing rate of the fish

5 How could Eleana and Jason be more certain the results of their experiment are reliable?

- A. use different water temperatures
- B. change the quantity of fish
- C. decrease the water in the aquarium
- D. repeat the experiment in the same way

6 What did Eleana and Jason do to make the results of their experiment valid?

- A. use different water temperatures
- B. use the same 3 fish at each interval
- C. measure gill movements per minute
- D. repeat the experiment in the same way

7 Write a conclusion for this investigation.

In your conclusion, be sure to:

- Answer the investigative question.
- Include **supporting** data from the Water Temperature vs. Breathing Rate table.
- Explain how these data **support** your conclusion.

Question: What is the effect of water temperature on the breathing rate of goldfish?

8 Plan a new investigation to answer Eleana and Jason’s new question printed in the box. Use a dissolved oxygen tool to measure the amount of oxygen dissolved in the water.

In your plan, be sure to include:

- Hypothesis
- Materials
- Procedure that includes:
 - logical steps to do the investigation
 - two controlled (kept the same) variables
 - one manipulated (changed) variable
 - one responding (dependent) variable
 - an experimental control condition
 - how often measurements should be taken and recorded

Question: What is the effect of water temperature on the amount of oxygen dissolved in the water?
Hypothesis:
Materials:
You may use this space for a labeled diagram to support your procedure.

Procedure:

9 The purpose of the cell cycle is to do which of the following?

- A. half the number of chromosomes
- B. allow for cell growth and development
- C. create gametes such as eggs and sperm
- D. build proteins such as insulin and enzymes

10 What is the correct relationship between genes and chromosomes?

- A. genes contain chromosomes
- B. chromosomes are carried on genes
- C. chromosomes are smaller than genes
- D. genes are carried on chromosomes

11 The chromosome number at the end of mitosis results in cells with

- A. the same number of chromosomes
- B. half the number of chromosomes
- C. a unique combination of chromosomes
- D. double the number of chromosomes

12 How many copies of each chromosome does a typical animal cell contain?

- A. 1
- B. 2
- C. 3
- D. 4

13 Which cycle would cellular respiration be a part of?

- A. carbon
- B. water
- C. nitrogen
- D. phosphorus

14 Which shows the correct order of energy flow?

- A. sun → consumer → producer
- B. sun → producer → consumer
- C. producer → sun → consumer
- D. producer → consumer → sun

15 An industrial farm releases high amounts of mineral nutrients such as nitrogen and phosphorous into a marine ecosystem, what would be the first noticeable change in the stability of the ecosystem?

- A. the plant populations increase thus increasing stability
- B. the animal populations will increase thus increasing stability
- C. the plant population will increase thus decreasing stability
- D. the animal populations will increase thus decreasing stability

16 Fertilizer has been introduced into fields where rabbits reside increasing both the grass population and the rabbit population. What type of feedback is represented?

- A. positive feedback
- B. negative feedback
- C. non-feedback
- D. neutral feedback

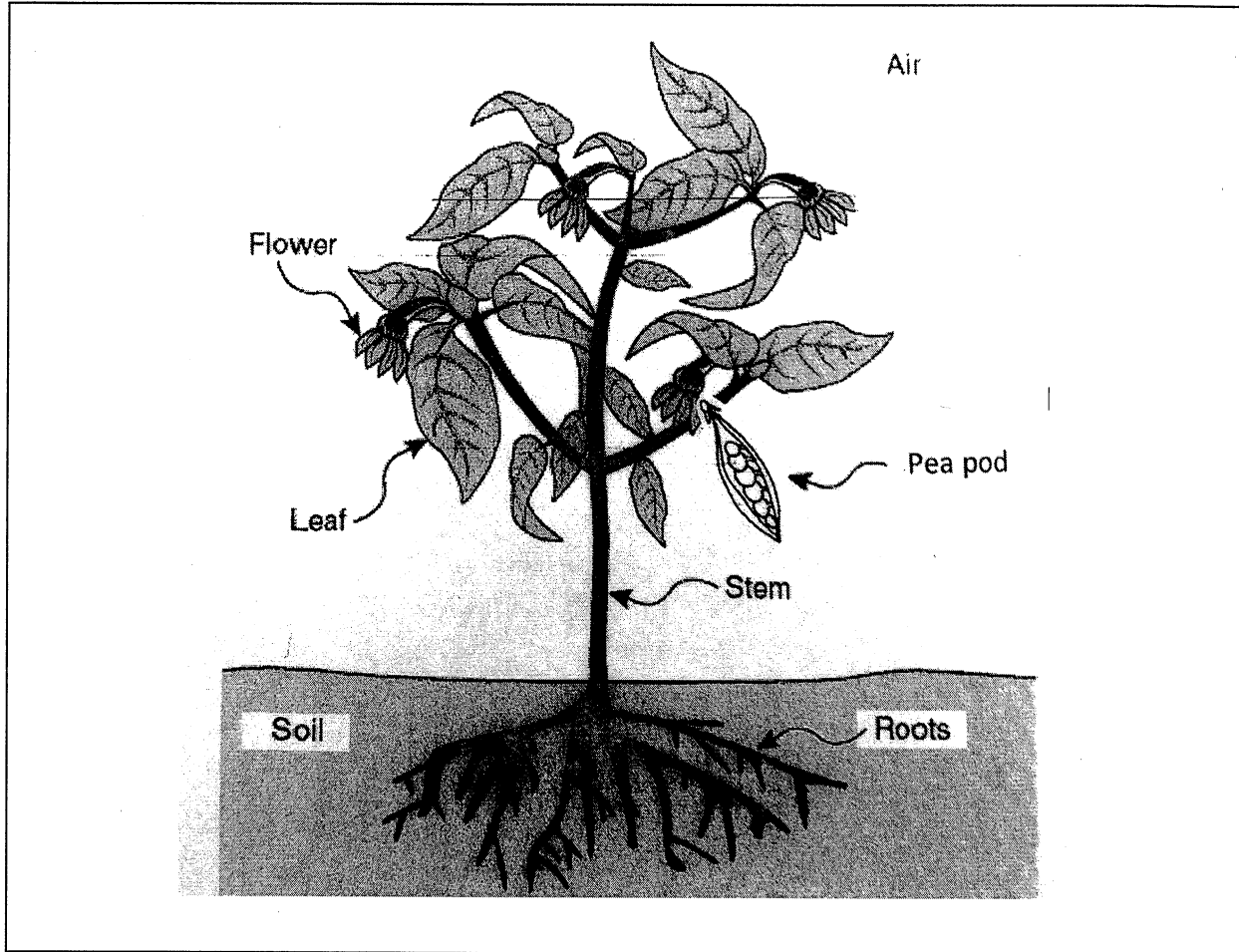
Genetics

Biology EOC Scenario

Mendel's Green Machine

Directions: Use the following information to answer question 1.

While helping to plant a school garden, Becky and Juan observed many different types of plants. They drew the following diagram of a green pea plant growing in the garden.



1 Referring to the diagram above, list one subsystem within the pea plant system.

2 What is the process that plants undergo to convert carbon into sugar.

3 Sugars are an important macromolecule that plants create. From which molecule do the plants obtain the carbon?

4 What microorganism is present in the roots of the pea plant that converts nitrogen in the atmosphere to a form that can be used by the pea plant?

- A. bacteria
- B. virus
- C. cell
- D. protist

5 Becky and Juan want to increase the mass of food produced in the school garden. Which of the following questions could lead to a possible solution to this problem?

- A. how much carbon dioxide do plants require?
- B. which mineral nutrients do plants need?
- C. which plants provide the most protein?
- D. which plant seeds are largest?

6 The green pea plant has proteins that control the process of making glucose. How does the plant obtain these proteins?

- A. the plant makes the proteins using the instructions in DNA.
- B. the proteins are absorbed from the soil by the roots of the plant.
- C. the light energy changes molecules in the plant cell into proteins.
- D. the proteins are all present in the seed before germination occurs.

7 What type of inheritance did Mendel's pea plants follow?

- A. dominant/recessive
- B. co-dominant/sex-linked
- C. dominant/sex-linked
- D. recessive/co-dominant

8 DNA codes for which macromolecule?

- A. lipids
- B. carbohydrates
- C. proteins
- D. nucleic Acids

9 In Mendel's pea plant experiment, round seeds are dominant to wrinkled seeds. If Mendel crossed two heterozygous round seeds what percent offspring would be wrinkled?

- A. 0%
- B. 25%
- C. 50%
- D. 75%

10 The purpose of meiosis is to

- A. produce identical cells
- B. produce cells with half the number of chromosomes
- C. produce cells with twice the number of chromosomes
- D. produce somatic cells

11 The process of fertilization is the restoration of

- A. cell number
- B. cell type
- C. chromosome number
- D. chromosome type

12 Many plants can reproduce through asexual (one parent) reproduction. How would the gene combinations in the parent plants compare to the gene combinations in the offspring?

- A. the parent plant would have fewer gene combinations
- B. the offspring plant would have twice as many gene combinations
- C. both parent and offspring would have the same gene combinations
- D. both parent and offspring would have different gene combinations

13 Why are newborn ladybugs genetically different from their parents?

- A. adult ladybugs change their genes to attract mates
- B. sexual reproduction results in variations of the offspring
- C. young ladybugs mutate their genes to adapt to the habitat
- D. eating aphids causes changes in the chromosomes of ladybugs

14 Complete the Punnett Square below for a cross involving one trait.

	A	a
a		
a		

15 Using the punnett square above, what is the probably that a hybrid (heterozygous genotype) will result?

- A. 0%
- B. 25%
- C. 50%
- D. 75%

16 Genes are carried on what type of structure?

- A. lipids
- B. nucleic Acids
- C. chromosomes
- D. proteins

17 How many copies of each chromosome do human somatic (body) cells contain?

- A. 1
- B. 2
- C. 23
- D. 46

18 A fruit fly has 8 chromosomes, how many sex chromosomes in a gamete?

- A. 1
- B. 2
- C. 3
- D. 4

19 Becky and Juan used a greenhouse as a model of a garden ecosystem to predict effects of amount of sunlight on green pea production in a garden ecosystem.

Describe **two** ways the greenhouse model may lead to unreliable predictions about the effects of amount of sunlight on green pea production in a garden ecosystem.

In your description, be sure to:

- Describe **two** differences that make a garden ecosystem more complex than the greenhouse.
- Describe how **each** difference could cause predictions about green pea production in a garden ecosystem to be unreliable.

One Way
Another Way

Evolution

Biology EOC Scenario

The Birds and Beaks

Nikki and Jon were studying a type of bird called the Medium Ground Finch shown in the picture. These birds live on one of the Galapagos Islands called Daphne Major shown in the map. Medium Ground Finches have beaks adapted for eating small, soft seeds.

Nikki and Jon learned that in 1977, a drought reduced the amount of small, soft seeds. The drought left mostly large, tough seeds that most Medium Ground Finches were unable to eat, and about 84% of the population died off. A year later the population of Medium Ground Finches had an average beak size bigger than the average beak size of the population before the drought.

Typical Medium Ground Finch



Map of the Galapagos Islands Off the Coast of South America

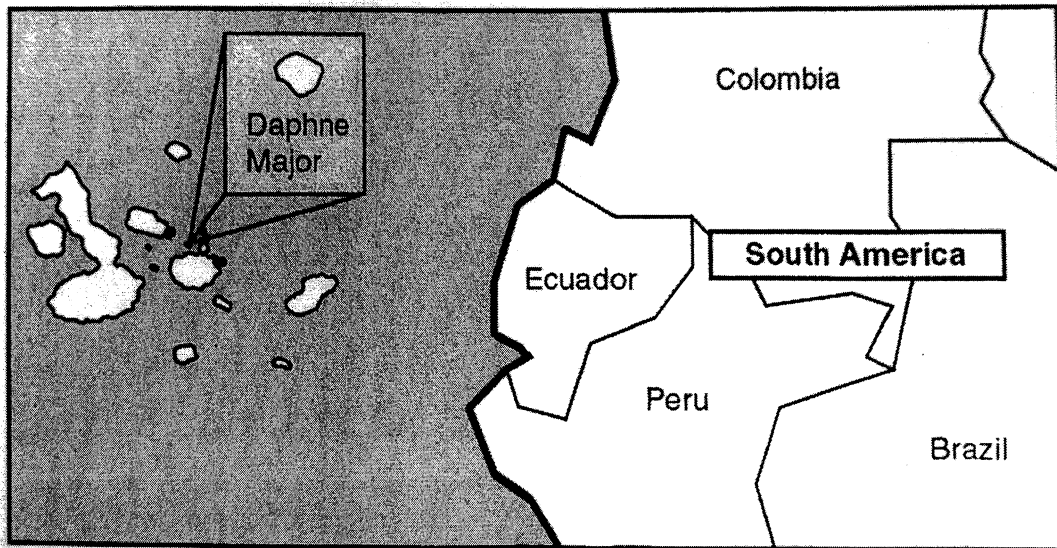


Diagram not to scale

1. What caused the increase in the average beak size of the finch population after the 1977 drought?

- A. finches' beaks grew bigger because of the lack of water.
- B. finches with small beaks were able to grow bigger beaks.
- C. finches with bigger beaks were unable to leave the island.
- D. finches with bigger beaks were able to survive and reproduce.

2. Scientists must be careful that their activities in an ecosystem do not introduce any new organisms into that ecosystem. What might be an effect on the finch population of Daphne Major if a new bird species were brought to the island?

- A. the finch population would decline due to reproduction.
- B. the finch population would increase due to adaptation.
- C. the finch population would decline due to competition.
- D. the finch population would increase due to predation.

3. Before the drought, Daphne Major had 720 finches living on 80 acres of land. What was the population density of finches on Daphne Major?

_____ finches per acre

4. Which type of consumer are the medium ground finches?

- A. primary
- B. secondary
- C. tertiary
- D. quaternary

5. The genetic variability of the finches to be better able to survive and produce offspring is due to

- A. sexual selection
- B. random mutations in the DNA
- C. natural selection
- D. all of the above

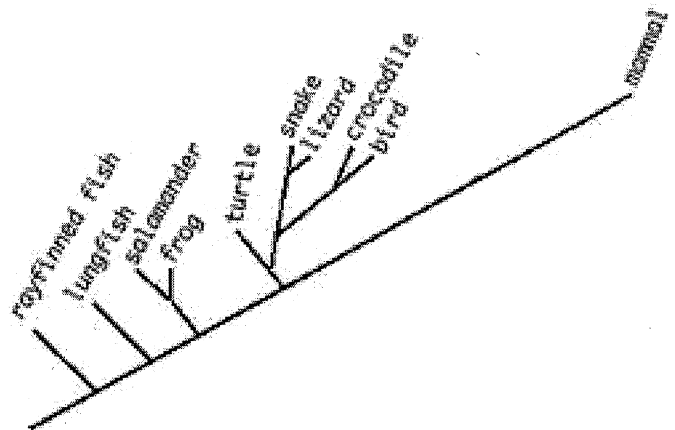
6. Finches on the Galapagos Islands had different beaks due to

- A. the amount of food
- B. the amount of water
- C. the type of water
- D. the type of food

7. A structure that seems to serve no purpose in an organism is a
- A. homologous structure
 - B. vestigial structure
 - C. fossilized structure
 - D. extinct structure
8. Mutations in DNA can be caused by all the following EXCEPT
- A. UV radiation
 - B. Insertions
 - C. Deletions
 - D. Translation
9. The bird's beaks were adaptations that allowed birds to survive in a changing condition. Which of the following represents the inherited adaptation that allows fish to survive?
- A. changes in fish size due to overfishing
 - B. changes in fish location due to overfishing
 - C. changes in fish flavor due to overfishing
 - D. changes in fish color due to overfishing
10. What shared physical characteristics do aphids and ladybugs have that makes them insects?
- A. Both reproduce sexually
 - B. Both breathe in oxygen
 - C. Both have six legs
 - D. Both eat food
11. Which of the following would provide the **best** evidence goldfish are more closely related to frogs than dragonflies?
- A. investigating the diet of each organism
 - B. observing the behavior of each organism
 - C. examining the habitat of each organism
 - D. analyzing the DNA from each organism

12. Using the diagram to the right, which organism is the frog most closely related to?

- A. salamander
- B. lungfish
- C. turtle
- D. rayfinned fish



Last Scenario!

Biology EOC Scenario

Mr. Brown's Farm

Directions: Use the following information to answer questions 1 through 9.

James and Maggie wondered if a change in flavor of a food substance affects the consumption by birds on that food substance. They did the following investigation. Food pellets were made with 4 different concentrations of quinine (a bitter substance) and placed randomly on a grid, marking the location of the different concentrations of quinine. 25 food pellets were made with 0% quinine, 10% quinine, 20% quinine, and 30% quinine. Data was collected for 4 days and all missing pellets were recorded. Each day all eaten pellets were replaced with the same concentration pellet. For example, if a 0% quinine pellet was eaten, then it was replaced with a 0% quinine pellet.

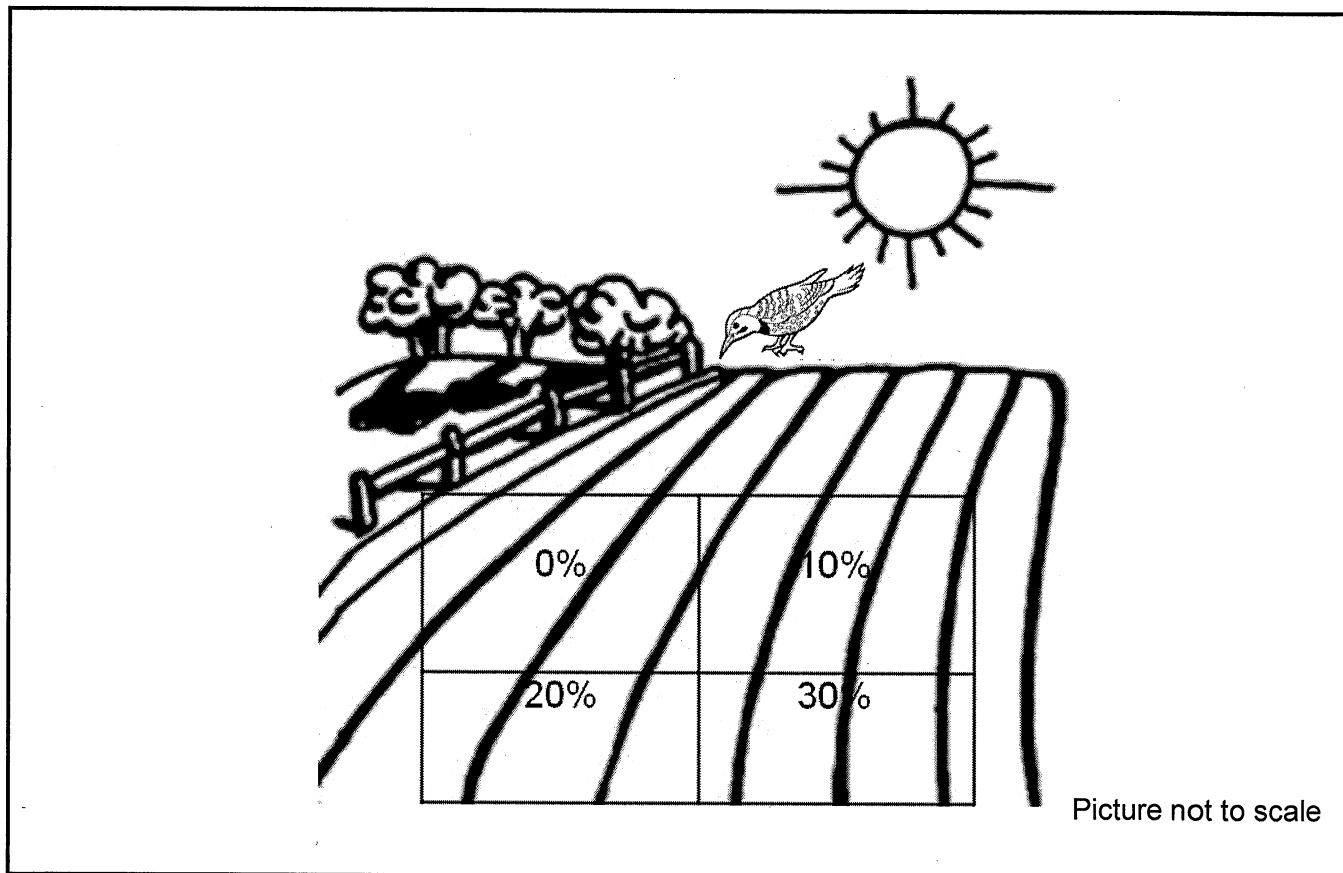
Question: What is the effect of concentration of quinine on the number of pellets consumed by the birds?

Hypothesis: The higher the quinine level, the lower the number of pellet consumed because birds would choose less bitter food pellets.

Materials:

1. Food pellets
2. Grid
3. Birds
4. Quinine
5. Study site

Investigation Setup



Procedure:

1. Go to Farmer Brown's field for the study.
2. Record location date and time in the data table.
3. Obtain a labeled grid and place in the field.
4. Count out 25 food pellets of each concentration and place in the appropriate location on the grid.
5. Wait 24 hours away from field site.
6. Return to Farmer Brown's field.
7. Count the number of pellets missing from each location and record in the data table.
8. Replace any missing food pellets so each grid contains 25 food pellets.
9. Repeat steps 5-8 for a total of 4 days.

Data:

Concentration of quinine vs. the number of pellets consumed by birds.

Manipulated Variable (% concentration of quinine)	Responding Variable (Number of pellets consumed)				
	Day 1	Day 2	Day 3	Day 4	Average
0%	15	18	21	25	20
10%	12	15	13	18	15
20%	3	2	3	1	2
30%	1	0	2	1	1

- 1 Which variables were controlled in this investigation?
- A. 25 pellets in each grid, location
 - B. concentration of quinine, location
 - C. 25 pellets in each grid, concentration of quinine
 - D. location, number of pellets, concentration of quinine
- 2 Which variable was the manipulated variable in this investigation?
- A. time of day
 - B. concentration of quinine
 - C. location
 - D. number of pellets per location

- 3** Which variable was the responding variable in this investigation?
- A. number of pellets consumed
 - B. concentration of quinine
 - C. the type of birds that ate the food pellets
 - D. location
- 4** How could James and Maggie make this experiment more reliable?
- A. repeat the experiment in the same way
 - B. test different concentrations of quinine
 - C. increase the quantity of food pellets
 - D. use a different bitter chemical
- 5** How did James and Maggie make their experiment valid?
- A. calculate the average number of pellets consumed each day.
 - B. repeat the experiment the same way
 - C. use four different concentrations quinine
 - D. wait 24 hours before recording pellet consumption
- 6** Glucose is produced through the process of photosynthesis. What form of energy does the glucose have because of photosynthesis?
- A. heat
 - B. light
 - C. nuclear
 - D. chemical

7 Write a conclusion for this investigation.

In your conclusion, be sure to:

- Answer the investigative question.
- Include **supporting** data from the **concentration of quinine vs. the number of food pellets consumed table.**
- Explain how these data **support** your conclusion.

Question: What is the effect of concentration of quinine vs. the number of food pellets consumed?

8 What type of consumer is a chicken that eats corn?

- A. primary
- B. secondary
- C. tertiary
- D. quaternary

9 If a genetic modification of a food source made the food source bitter, predict what might happen to a bird population that depended on that food source based on the data in the scenario.

- A. the population would decrease
- B. the population would increase
- C. no change
- D. the population would increase then decrease

10 Energy in the system comes from the

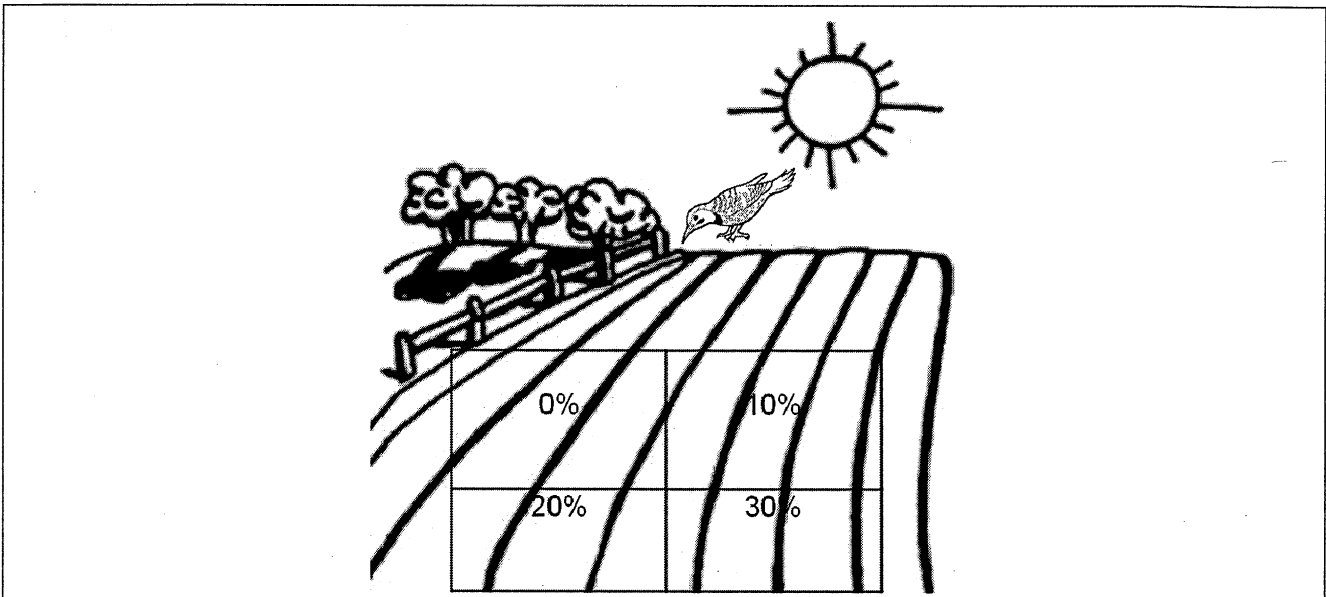
- A. sun
- B. food pellets
- C. birds
- D. trees

11 Describe **two** energy transfers that happened in the diagram below.

In your description, be sure to:

- Identify the **forms** of energy before and after each transfer.
- Describe **where** the energy transfers happen.

You may use words, labeled pictures, and/or labeled diagrams on the diagram below.



Energy Transfer #1

Energy Transfer #2

Appendix A - EOC Scoring Rubrics

PROCEDURE

Investigation Attributes	Description of Attribute	Value Point
Procedure	The written or diagrammed procedure is evaluated as follows.	
Controlled (kept the same) Variables	At least two controlled (kept the same) variables must be identified or implied in the procedure or the materials list (e.g. same type of seeds or plants, same amount of soil, water, and light, same temperature).	1
Manipulated (changed) Variable	Only one manipulated (changed) variable is identified or implied in the procedure or data table, if given (e.g. size of space above or below ground).	1
Responding (dependent) Variable	The responding (dependent) variable identified or implied in the procedure or data table, if given (e.g. health of plants as measured by height and number of leaves).	1
Record Measurements	The procedure states or implies measurements are recorded periodically or gives a data table. If artificial data for the responding variable is given, no value point may be awarded. The phrase 'take measurement' cannot be used to mean record.	1
Trials are Repeated	More than one trial is planned, or implied in a data table, to measure the responding (dependent) variable. Including more than one plant for each condition is comparable to repeated trials.	1
Extra Validity Measures	Additional validity measures that were not included in the scenario investigation should be included in the procedure (e.g. plant seeds at the same depth).	1
Logical Steps	The steps of the procedure are detailed enough to repeat the procedure effectively.	1
Total Value & Score Points Possible:		7 2

CONCLUSION

Scoring for Writing a Conclusion	Value Point
Conclusive Statement:	1
Lowest Condition Supporting Data:	1
Highest Condition Supporting Data:	1
Explanatory Language:	1
Scientific Explanation:	1
Total Value & Score Points	5 2

Appendix B

Science Vocabulary Used in Assessment Items

Items on the biology end-of-course exam use language targeted to an eighth grade or lower readability with the exception of the required biology terms in the following list. Appropriate science vocabulary allowed for all earlier grade level science assessments may also be used on the biology end-of-course exam. Example vocabulary from life science in earlier grade levels is also included in the following list.

a

Used in grade 8:

accuracy
acquired (learned)
characteristic
adaptation
asexual reproduction
atom

Used in Biology:

absorption
active transport
allele
amino acid
atmospheric
ATP
aquatic

b

Used in grade 8:

boundary

Used in Biology:

bacteria
bacterium
bi-layer
biodiversity
biomass

c

Used in grade 5:

characteristic
classify
conclude
conclusion
conserve

consumer
controlled experiment
cycle

Used in grade 8:

cell membrane
cell nucleus
cell wall
chemical energy
chemical reaction
chloroplast
chromosomes
circulatory system
closed system
compound

Used in Biology:

carbon cycle
carbon dioxide
carbohydrates
cellular respiration
chlorophyll
combustion
complementary
computer simulation
concentration
constraint
contraction
criteria
cytoplasm

d

Used in grade 5:

data
decomposer
dissolve

Used in grade 8:

digestive system
dominant

Used in Biology:

diffusion
divergent
diversity
DNA

e

Used in grade 5:

ecosystem
energy
environment
evidence
experimental question
extinct

Used in grade 8:

effective
element
evolution

Used in Biology:

embryo
endangered
endocrine system
energy chain
enzyme
equilibrium
estuary
expansion
experimental control condition

f

Used in grade 5:

field study
food web
form of energy
fossil
function

Used in grade 8:

factor
filter

Used in Biology:

facilitated diffusion
fatty acids
finite
fossil fuels
fungus

g

Used in grade 8:

gene
genetic
glucose

Used in Biology:

gender
gene pool
genetic cross
genetic recombination
genotype
glucose

h

Used in grade 5:

habitat

Used in Biology:

heterozygous
homozygous
honesty
hormone
host
hydrosphere

i

Used in grade 5:

inherited
input
investigation

Used in grade 8:

impact
infer

Used in Biology:

invasive

k

Used in grade 8:

kinetic energy

l

Used in grade 5:

light energy

Used in Biology:

lipid bi-layer

m

Used in grade 8:

mitochondria
mitochondrion
molecule

Used in Biology:

mammals
meiosis
microorganism
mitosis
mRNA
mutate
mutation

n

Used in Biology:

native
natural selection
negative feedback
neurological system
niche
nitrogen cycle
non-native
nonrenewable
nucleic acid
nucleotides

o

Used in grade 5:

organism
output

Used in grade 8:

offspring
open system

Used in Biology:

organelle
osmosis
ova
ozone

p

Used in grade 5:

particle
pollution
population
predator
predict
prediction
procedure
producer

Used in grade 8:

particles
photosynthesis
prey

Used in Biology:

parasite
passive transport
pesticide
pH
phenotype
photosynthesize
pistil
pollinator
population density
positive feedback
principle
protein

r

Used in grade 5:

recycle
redesign
reliable
resource

Used in grade 8:

recessive
respiratory system
ribosome

Used in Biology:

regulate
reliability
renewable
reproduce
research question

s

Used in grade 5:

structure
subsystem
summary
survive

Used in grade 8:

sexual reproduction
skeletal system
soluble
species

Used in Biology:

sensor
skeptical
solubility
solution (aqueous)
species
sperm
spherical
spinal cord
spore
stamen
succession
sustainability
systematic observation

t

Used in grade 5:

technology
texture
thermometer
transform
transformation

Used in grade 8:

thermal (heat) energy
tissue

Used in Biology:

theory
toxin
trade-off
trait
transmission
trend
tRNA

u

Used in Biology:

unintended consequence

v

Used in grade 5:

variable
versus (vs.)

Used in grade 8:

valid

Used in Biology:

vacuole
validate
validity
virus